SAGE Guideline Modeling: Motivations and Methodology

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• **SAGE: Standards-Based Active Guideline Environment**
• Deployment-Driven Guideline Modeling
• Compliance with Standards
• SAGE Decision-Support System Architecture
• Results and Conclusions
SAGE: Standards-Based Active Guideline Environment

- 3-year US NIST Advanced Technology Program grant
- IDX leads R&D consortium that includes as partners:
  - Apelon, Inc.
  - Stanford Medical Informatics (SMI)
  - Intermountain Healthcare (IHC)
  - University of Nebraska Medical Center (UNMC)
  - Mayo Clinic
- Ultimate goal: An infrastructure that will allow execution of standards-based clinical practice guidelines across heterogeneous clinical information systems (CIS)
- Focus is on the goal of deployment of guideline knowledge within the workflow of clinical information systems
• Assumption: Guideline DSS is reactive
  • Not in control of clinical workflow
  • Respond to external events (including passage of time)
• Methodology
  • Empirically define points in care processes where guideline DSS may provide services
  • Discover characteristics of human-computer interactions that enhances prospect of acceptance
• Method
  • Create scenarios that walk-through care process
  • Create prototype GUI to validate in usability lab
Clinical scenario: Patient arrives for visit with primary physician. At check-in, SAGE checks for immunizations that are due and prints consents and information sheets. Nurse then reviews any other shots received, updates the record, and SAGE pre-order immunizations to be given that day.
Mayo Usability Lab

- Prototypes tested by clinicians in Mayo usability lab
Scenario development defines events and actions that SAGE must respond to and generate. Scenarios help to define what guideline knowledge must be encoded and what data must be queried.
Top-Level Workflow-Aware Process

- Top-level process description in encoded guideline reflect expected reactions to events in clinical workflow.
Context nodes organize and specify the relationship to workflow. They record:

- Who is involved
- Where the session occurs
- What resources are required
- Clinical Information processing
- What triggers or begins session
Sub-guidelines

Can be thought of as reusable subsets of guideline logic (much like subroutines) for repeated use within a recommendation set.
Compliance with Standard....

- Take existing components whenever possible
  - Data types: HL7 version 3 data types
  - Reference terminology: SNOMED CT, LOINC, NDF-RT
  - Patient data model: “virtual medical record” being defined by HL7 Clinical Decision Work TC
  - Expression language: GELLO

- Difficulties
  - Moving targets: e.g. GELLO not well specified until 2004/03
  - Mismatches
    - e.g. between guideline concepts and terminology concepts
Specifying a Decision Criterion: Presence of Chronic Pulmonary Disease (excl asthma)

- **GELLO**
  - `Collection->exists(attribute.equals(value))`
- **Virtual Medical Record**
  - `Problem-> exists(code.equals(Factory.CodedValue(...) )`
- **Terminology**
  - `CodedValue`
    - `display_name: Chronic pulmonary disease (excl asthma)`
    - `terminology SAGE`
    - `code 434343`
  - `Concept expression`
    - `(SNOMED 128272009) AND (SNOMED 128272009) AND (NOT (SNOMED 195967001))`
    - Chronic respiratory disease AND Disease of lower respiratory system AND (NOT Asthma)
Integration of SAGE Decision-Support System with Clinical Information System

CIS (CareCast)

- VMR Services
- Action Services

Event Notification

Event Listener

SAGE Execution Engine and Guideline Knowledge Bases

- VMR Service Calls
- Action Service Calls

Terminology Server
Results and Conclusions

- Prototype specification and implementation
- Working cycles of scenario development, guideline encoding, and simulation in CIS environment for exemplar guidelines:
  - Immunization, Diabetes
  - Community-acquired pneumonia, Hip replacements
- Good understanding of components of infrastructure required to integrate standard-based guideline DSS with CIS
- Involvement with standard organization (Health Level 7) to reconcile SAGE project results with emerging version 3 standards